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ELECTRONIC DISKETTE UNIT

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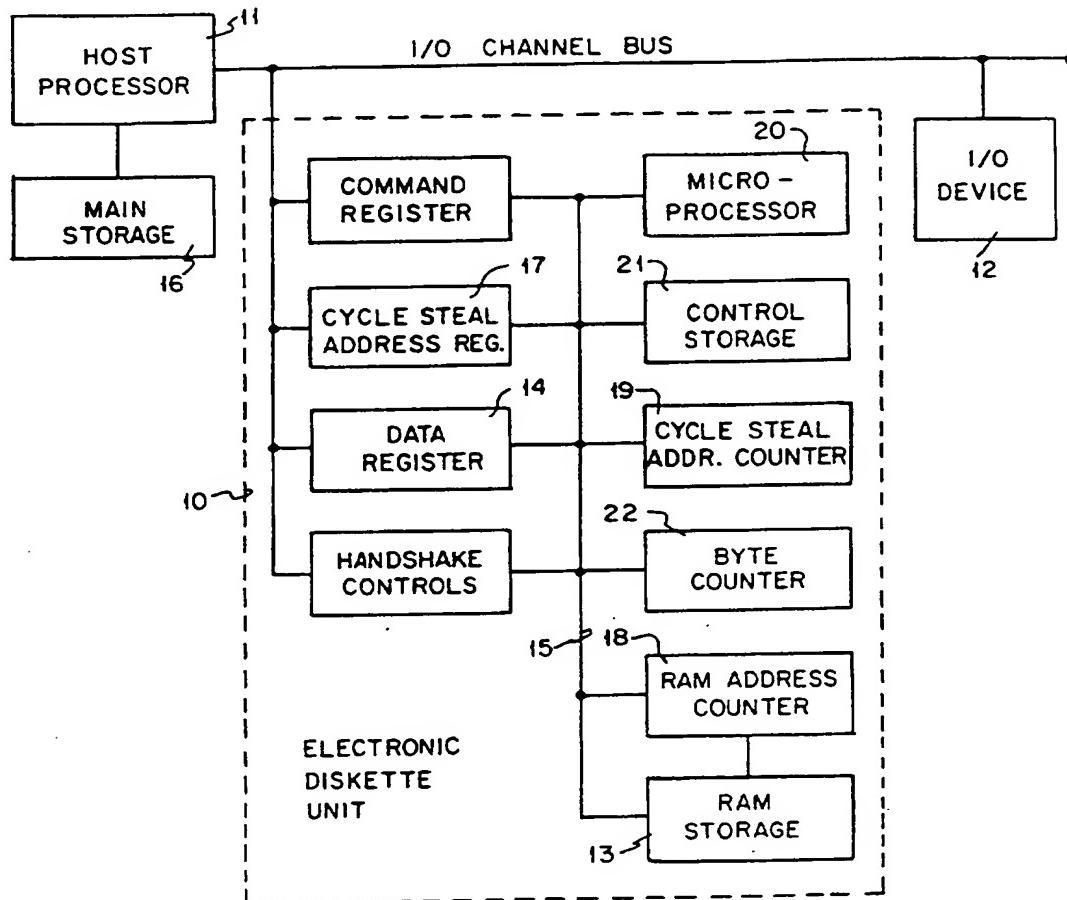
A non-mechanical electronic diskette unit 10 is described which may be used as a direct replacement for a floppy disk-type magnetic diskette unit with minimal software changes in a host processor 11. The electronic diskette unit 10 is coupled to the host processor I/O channel bus in the same manner as other I/O devices 12. As far as the host processor 11 is concerned, the electronic diskette unit 10 behaves the

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same as the traditional mechanical-type floppy disk unit. The elec-
tronic diskette unit 10, however, has a much faster operating speed
than does the mechanical-type floppy disk unit.

For sake of example, the host processor 11 is assumed to be an IBM
Series/1-type processor, and the typical operations described herein
for the electronic diskette unit 10 will be in accordance with the
requirements of the Series/1 architecture.

The electronic diskette unit 10 uses a random-access memory (RAM)
storage unit 13 in place of the traditional floppy disk magnetic medi-
um. Data is transferred between the host processor 11 and this RAM
storage 13 by way of the processor I/O channel bus, a data register 14
and a microprocessor bus 15. These data transfers are performed in a
cycle steal mode relative to the main storage 16 of the host processor
11. The main storage address is supplied to the processor 11 by a
cycle steal address register 17, while the RAM storage address is sup-
plied to the RAM storage 13 by a RAM address counter 18. A cycle steal
address counter 19 is incremented, and the updated main storage address
is loaded into the cycle steal address register 17 for each byte of
data transferred to or from the main storage 16. A microprocessor 20
operates in accordance with a microcode control program resident in a
control storage unit 21 to supervise the operation of and to control
the movement of data, addresses and the like between the various units
contained in the electronic diskette unit 10. A byte counter 22 keeps
track of the number of data bytes that have been transferred and sig-
nals the microprocessor 20 when all the bytes in a diskette sector have
been transferred.

Depending on the particular diskette format being used, a diskette
sector may include 128, 256, 512 or 1024 bytes of data. For any given
diskette read or diskette write operation, a complete sector is trans-
ferred from or to the diskette unit, as the case may be. At the be-
ginning of each diskette read or diskette write operation, an eight-
word device control block is transferred from the host processor 11 to
the electronic diskette unit 10 and stored in the control storage 21.
Among other things, this device control block includes the following
diskette parameters: cylinder number, head number, sector number,
sector size and an indication of whether or not double dense recording
is being used. This device control block also includes the main stor-
age 16 starting address and the byte count for the data transfer. The
main storage starting address is loaded into the cycle steal address
counter 19, and the byte count is loaded into the byte counter 22.

It is necessary to convert the cylinder number, head number, sec-
tor number and sector size values obtained from the device control
block into a starting address for the RAM storage unit 13. This con-
version is accomplished by the microprocessor 20 and the appropriate
microcode algorithm in the control storage 21. This conversion algo-
rithm solves the following mathematical equation:

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$$\text{Starting RAM Address} = 2CT + HT + S(N-1)$$

where: C = cylinder number
T = formatted track size (data bytes per track)
H = head number (0 or 1)
S = sector size (data bytes per sector)
N = sector number (first sector = 1)

This RAM starting address is loaded into the RAM address counter 18. Thereafter, for any given read or write operation, the RAM address counter 18 is incremented by one count as each byte of data is transferred to or from the RAM storage 13. This process, together with the cycle stealing of data bytes to or from the main storage 16, continues until the byte counter 22 indicates that all the bytes in a diskette sector have been transferred. In this manner, a set of contiguous storage addresses in the RAM storage 13 are substituted for the contiguous physical storage locations in a given sector on the magnetic disk.

The above equation is for the case of a two-sided floppy disk having a first head on one side and a second head on the other side. In this regard, the head number factor "H" has a value of 0 when the first head is being used and a value of 1 when the second head is being used. This equation enables all of the available space in the RAM storage 13 to be efficiently used with no gaps between neighboring sector zones.

For the case of a single-sided floppy disk having a single head, the conversion algorithm reduces to the following equation:

$$\text{Starting RAM Address} = CT + S(N-1)$$

The formatted track size T is determined from the sector size value and the single/double density indicator value. The standard floppy disk formats are such that, for any given sector size value, there is a particular number of sectors per disk track. Thus, for normal recording, the track size is determined by multiplying the sector size by this known sector per track value. If double density recording is used, this track size value is doubled.

During any given period of use of the electronic diskette unit 10, such unit is dedicated to a particular floppy disk format which is the same as that of the mechanical diskette unit it is replacing. The preferred way of accomplishing this is by means of a diskette format command which is sent to the electronic diskette unit 10 from the processor 11 as part of the power-on system initialization program. This diskette format command would include the formatted track size value which is to be used by the microprocessor 20 in determining the RAM storage starting addresses. This diskette format command would also include an indicator bit which indicates whether a one-side or a two-side format is to be used. This enables the microprocessor 20 to choose between the two conversion equations given above.

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